



NIRT: Self-Aligned and Self-Limited Quantum Dot Nanoswitches

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The accomplishment being highlighted to the right is the development of photoresist technology to shrink the length scale of the directly written patterns. Using 50 kV electron beam lithography, we demonstrate the achievement of isolated 6 nm-wide lines and 27 nm-period gratings in 30 nm Hydrogen silsesquioxane (HSQ) films on silicon substrates. This work was leveraged to illustrate linear arrays of oxidized quantum dots that show the topology needed to promote dot-to-dot interactions for a variety of quantum functional device-based architectures.

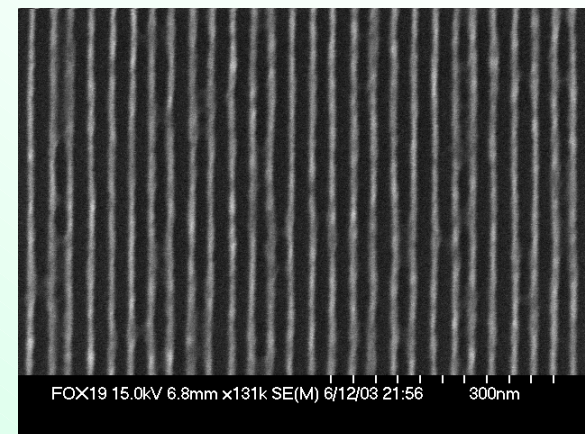


Fig. 1: 27 nm-period grating exposed in 30 nm-thick HSQ resist on Si of ~ 6 nm lines at 30 nm-period (Courtesy of M. J. Word and I. Adesida at University of Illinois at Urbana-Champaign).

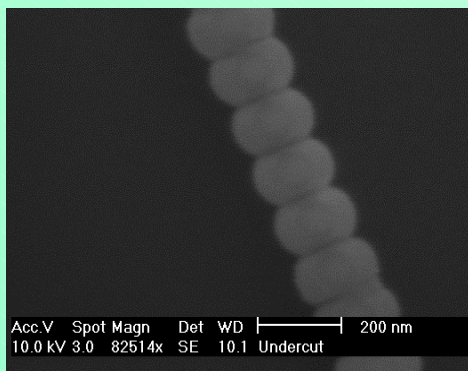


Fig. 2: SEM picture of adjacent quantum dots with 125 nm period after oxidation showing the tight coupling of adjacent nodes. This is an excellent topology for quantum cellular automata. (Courtesy of N. Jin and P. R. Berger at Ohio State University).

"Nanometer-Period Gratings in Hydrogen Silsesquioxane Fabricated by Electron Beam Lithography," Michael J. Word, Ilesanmi Adesida, and Paul R. Berger, *Rapid Comm. in J. Vac. Sci. Tech. B*, **21**, pp. L12-L15 (Nov/Dec 2003).

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Broader Impacts: Supplemental NSF Research Experiences for Undergraduates (REU) awards have been leveraged with other REU awards and matching funds from the Center for Materials Research to support 9 undergraduate researchers (4 girls/5 boys) and 1 high school researcher (1 girl) during the Summer 2003. The NSF support has greatly strengthened a recent proposal submission for an NSF REU Site (PI: Berger) with OSU matching monies. **This will potentially support 15-20 undergraduate students and establish an Undergraduate Research Institute within ECE.**



Fig. 3: Berger research group pictured with the REU participants (Summer 2003).

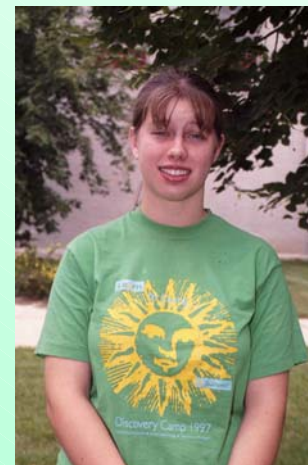


Fig. 4: Pictures of REUs at work in the lab and on the computer. Also shown is a volunteer high school researcher (Ms. Sarah Sheldon).